

CLAIMS

1. An apparatus for transmitting a signal from deep in a wellbore through a string of tubulars said apparatus comprising an signal conductor and a tubular
5 characterised in that said signal conductor is located adjacent an interior surface of said tubular.
2. An apparatus as claimed in Claim 1, wherein said signal conductor is an electrical conductor.
3. An apparatus as claimed in Claim 2, wherein said
10 electrical conductor is isolated from said interior surface of said tubular by a layer of electrically insulative material.
4. An apparatus as claimed in Claim 3, wherein said interior surface of said tubular is coated in said
15 insulative layer.
5. An apparatus as claimed in any of Claims 2 to 5, wherein said electrical conductor is a wire.
6. An apparatus as claimed in Claim 5, wherein said wire is embedded in a protective layer.
- 20 7. An apparatus as claimed in any of Claims 2 to 4, wherein said electrical conductor is a piece of foil.
8. An apparatus as claimed in Claim 7, wherein a protective layer covers said sheet of foil.
9. An apparatus as claimed in any preceding claim,
25 wherein said electrical conductor comprises a micro strip line.
10. An apparatus as claimed in Claim 9, wherein said micro strip comprises a conductive core and an insulating layer encasing said conductive core.
- 30 11. An apparatus as claimed in Claim 10, wherein said core is in the form of a rectangular section strip.
12. An apparatus as claimed in Claim 10 or 11, wherein

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said core is between 0.048mm (0.0019") and 0.05mm (0.002") thick.

13. An apparatus as claimed in Claim 10, 11 or 12, wherein said micro strip line has an overall thickness of
5 less than 1mm.

14. An apparatus as claimed in any of Claims 10 to 13, wherein said insulating layer is encased in an outer conductive layer.

15. An apparatus as claimed in Claim 14, wherein said
10 outer conductive layer is earthed.

16. An apparatus as claimed in any preceding claim wherein said signal conductor extends substantially the entire length of said tubular.

17. An apparatus as claimed in any preceding claim,
15 wherein said tubular comprises a plurality of signal conductors.

18. An apparatus as claimed in Claim 17, wherein one of said plurality of signal conductors carries said signal and another of said signal conductors carries
20 substantially the same signal.

19. An apparatus as claimed in any preceding Claim, wherein said signal conductor is provided with means for transferring said signal from said signal conductor to another signal conductor in an adjacent tubular.

25 20. An apparatus as claimed in any preceding claim, wherein said signal conductor is provided with an antenna at at least one end of said tubular.

21. An apparatus as claimed in any preceding claim, wherein a receiving antenna is provided at one end of
30 said tubular and a transmitting antenna is provided at the other end of said tubular, said signal conductor arranged therebetween.

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22. An apparatus as claimed in claim 20 or 21, wherein said antenna comprises the electrical conductor following the interior perimeter of said tubular.
23. An apparatus as claimed in any preceding claim
5 further comprising an amplifier-receiver.
24. An apparatus as claimed in claim 23, comprising the transmission apparatus as claimed in any of claims 29 to 45.
25. An apparatus as claimed in any preceding claim,
10 wherein said signal conductor is arranged in a recess in said interior wall of said tubular.
26. An apparatus as claimed in any preceding claim, wherein said tubular is drill pipe.
27. A method for transmitting a signal from deep in a
15 wellbore through a string of tubulars, the method comprising the steps of passing said signal through an electrical conductor located adjacent an interior surface of said tubular.
28. A method for manufacturing a drill pipe, the method
20 comprising the steps of positioning and fixing an electrical conductor adjacent an interior surface of a drill pipe section.
29. A transmission apparatus for transmitting a signal from deep in a wellbore through a string of tubulars,
25 said apparatus comprising an electrical conductor arranged in a tubular characterised in that the apparatus further comprises an amplifier-repeater.
30. A transmission apparatus as claimed in Claim 29, wherein said amplifier-repeater comprises a signal
30 amplifier and a power source.
31. A transmission apparatus as claimed in Claim 32, wherein said power source comprises a piezoelectric

device.

32. A transmission apparatus as claimed in Claim 30 or 31, wherein said power source comprises a battery.

5 33. A transmission apparatus as claimed in any of Claims 29 to 32, further comprising a receiver antenna.

34. A transmission apparatus as claimed in any of Claims 29 to 33, wherein said electrical conductor comprises a transmitter antenna.

10 35. A transmission apparatus as claimed in any of Claims 29 to 34, wherein said apparatus further comprises a transmitter antenna.

36. A transmission apparatus as claimed in any of Claims 29 to 35, wherein said electrical conductor comprises a receiver antenna.

15 37. A transmission apparatus as claimed in any of Claims 29 to 36, further comprising a second electrical conductor and a second amplifier-repeater.

20 38. A transmission apparatus as claimed in Claim 37, further comprising communication means between said first and second amplifier repeaters.

39. A transmission apparatus as claimed in any of Claim 37, further comprising a third electrical conductor and a third amplifier-repeater.

25 40. A transmission apparatus as claimed in Claim 39, further comprising communication means between said first, second and third amplifier repeaters.

41. A transmission apparatus as claimed in any of Claims 39, further comprising a fourth electrical conductor and a fourth amplifier-repeater.

30 42. A transmission apparatus as claimed in Claim 41, further comprising communication means between said first, second, third and fourth amplifier repeaters.

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43. A transmission apparatus as claimed in any of Claims 29 to 42, wherein said amplifier repeater is located in a ring.

5 44. A transmission apparatus as claimed in Claim 44, wherein said tubular is a drill pipe having a threaded pin at one end and a threaded box at the other wherein said ring is insertable in the box of one drill pipe section and fixed in position by the pin of an adjacent drill pipe section.

10 45. A transmission apparatus as claimed in Claim 43 or 44, wherein said ring comprises a plurality of receiver-amplifiers.

46. A ring of the transmission apparatus as claimed in any of Claims 29 to 45.

15 47. A ring comprising at least one amplifier-repeater, a power supply, a receiver antenna, a transmitter antenna.

48. A ring as claimed in claim , further comprising at least a second amplifier-repeater, a power supply, a receiver antenna, a transmitter antenna.

20 49. A tubular comprising the transmission apparatus as claimed in any of claims 29 to 45.

50. A string of the tubulars as claimed in Claim, said tubulars connect end to end, wherein said amplifier-repeaters are in series and are powerful enough to drive
25 the signal past at least one following amplifier repeater and on to a third amplifier repeater.

51. A method for transmitting a signal from deep in a wellbore through a string of tubulars, said method comprising the steps of passing a signal through an
30 electrical conductor arranged in a tubular and amplifying said signal with an amplifier-repeater to enable the signal to travel at a distance substantially equal to

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between one and ten lengths of said tubular.

52. A method as claimed in Claim 51, wherein said signal is amplified by said amplifier-repeater to enable the signal to travel at a distance substantially equal to
5 three to five lengths of said tubular.

53. A method as claimed in Claim 51 or 52, further comprising the step of passing the same signal through a second electrical conductor arranged in the tubular and amplifying said signal with a second amplifier-repeater
10 to enable the signal to travel at a distance substantially equal to between one and ten lengths of said tubular.

54. A method as claimed in Claim 53, wherein said first and second amplifier-repeaters are in parallel and have
15 communication means between them.

device.

32. A transmission apparatus as claimed in Claim 30 or 31, wherein said power source comprises a battery.

33. A transmission apparatus as claimed in any of Claims
5 29 to 32, further comprising a receiver antenna.

34. A transmission apparatus as claimed in any of Claims 29 to 33, wherein said electrical conductor comprises a transmitter antenna.

35. A transmission apparatus as claimed in any of Claims
10 29 to 34, wherein said apparatus further comprises a transmitter antenna.

36. A transmission apparatus as claimed in any of Claims 29 to 35, wherein said electrical conductor comprises a receiver antenna.

37. A transmission apparatus as claimed in any of Claims
15 29 to 36, further comprising a second electrical conductor and a second amplifier-repeater.

38. A transmission apparatus as claimed in Claim 37,
further comprising communication means between said first
20 and second amplifier repeaters.

39. A transmission apparatus as claimed in any of Claim 37, further comprising a third electrical conductor and a third amplifier-repeater.

40. A transmission apparatus as claimed in Claim 39,
25 further comprising communication means between said first, second and third amplifier repeaters.

41. A transmission apparatus as claimed in any of Claims 39, further comprising a fourth electrical conductor and a fourth amplifier-repeater.

42. A transmission apparatus as claimed in Claim 41,
30 further comprising communication means between said first, second, third and fourth amplifier repeaters.

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43. A transmission apparatus as claimed in any of Claims 29 to 42, wherein said amplifier repeater is located in a ring.

5 44. A transmission apparatus as claimed in Claim 44, wherein said tubular is a drill pipe having a threaded pin at one end and a threaded box at the other wherein said ring is insertable in the box of one drill pipe section and fixed in position by the pin of an adjacent drill pipe section.

10 45. A transmission apparatus as claimed in Claim 43 or 44, wherein said ring comprises a plurality of receiver-amplifiers.

46. A ring of the transmission apparatus as claimed in any of Claims 29 to 45.

15 47. A ring comprising at least one amplifier-repeater, a power supply, a receiver antenna, a transmitter antenna.

48. A ring as claimed in claim , further comprising at least a second amplifier-repeater, a power supply, a receiver antenna, a transmitter antenna.

20 49. A tubular comprising the transmission apparatus as claimed in any of claims 29 to 45.

50. A string of the tubulars as claimed in Claim, said tubulars connect end to end, wherein said amplifier-repeaters are in series and are powerful enough to drive
25 the signal past at least one following amplifier repeater and on to a third amplifier repeater.

51. A method for transmitting a signal from deep in a wellbore through a string of tubulars, said method comprising the steps of passing a signal through an
30 electrical conductor arranged in a tubular and amplifying said signal with an amplifier-repeater to enable the signal to travel at a distance substantially equal to

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between one and ten lengths of said tubular.

52. A method as claimed in Claim 51, wherein said signal is amplified by said amplifier-repeater to enable the signal to travel at a distance substantially equal to
5 three to five lengths of said tubular.

53. A method as claimed in Claim 51 or 52, further comprising the step of passing the same signal through a second electrical conductor arranged in the tubular and amplifying said signal with a second amplifier-repeater
10 to enable the signal to travel at a distance substantially equal to between one and ten lengths of said tubular.

54. A method as claimed in Claim 53, wherein said first and second amplifier-repeaters are in parallel and have
15 communication means between them.